

Model 814FP Pulser

User's Manual

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1. Introduction

The Canberra 814FP Pulser is a single-width NIM module designed to simulate the output from a solid-state or scintillation detector/preamplifier combination, thereby providing a means of testing and calibrating the electronics in a nuclear counting system.

The 814FP offers a fast rise time (typically 10 ns) signal and variable repetition rates of up to 2 kHz. Either square wave or tail pulse outputs are selectable. The 814FP is unique in that the square wave output will not degrade the resolution of a gamma spectroscopy system even if it is run simultaneously with a germanium detector. Other tail pulsers introduce an additional pole into the preamplifier/amplifier combination, preventing the amplifier from properly pole/zeroing the system. This results in spectrum broadening, especially on the low energy side.

The 814FP can be calibrated to read directly in terms of energy with the ten-turn precision PULSE HEIGHT potentiometer, NORMAlize control and ATTENUATOR switches. The PULSE HEIGHT control has a maximum nonlinearity of +0.25% and the ATTENUATORS use 1% resistors.

Calibration of nuclear spectroscopy systems and multichannel analyzers, evaluation of system stability, measuring the integral nonlinearity and noise of amplifiers, and selecting delays in coincidence timing systems are typical of the wide range of applications for the Canberra 814FP Pulser. The variable repetition rate is also useful in determining the system's count rate performance.

The 814FP offers either a direct output or an attenuated output. When all the attenuator switches are in the "out" position the output is direct. Attenuation factors of up to 1000:1 are selectable via two-position switches with gold-plated contacts. These contacts greatly improve both the reliability and the long-term stability of the attenuator section.

A DISABLE input is featured on the 814FP for gated operation and is selectable as active High or active Low for interfacing with a wide variety of devices. It is also synchronized with the internal pulse generator to prevent erroneous outputs. The disable feature enables the 814FP to be turned on or off by remote or computer control.

A SYNC output is provided on the front panel for convenient oscilloscope triggering while monitoring either the system output or waveforms from the 814FP.

2. Controls and Connectors

Front Panel

This is a brief description of the 814FP's front panel controls and connectors. For more detailed information, refer to Appendix A, Specifications.

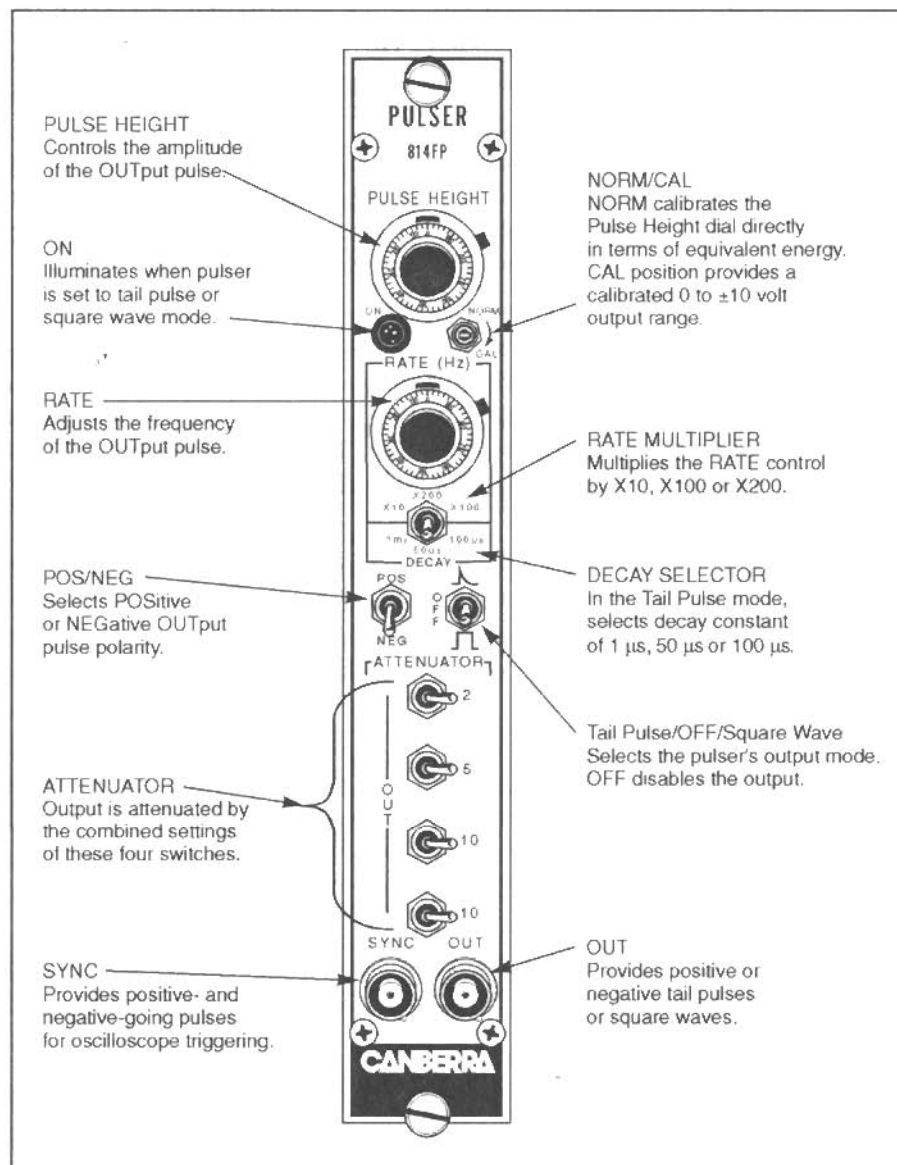


Figure 1 Front Panel Controls and Connectors

3. Pulser Operation

The Canberra Model 2000 Bin and Power Supply, or other bin and power supply systems conforming to the mechanical and electrical standard set by DOE/ER-0457T will accommodate the Model 814FP.

Before installing the Model 814FP in the NIM Bin, the internal controls, accessible through cutouts in the side cover, should be set to their desired positions.

The right side cover of the NIM module acts as a guide for insertion of the instrument. The module is secured in place by turning the two front panel captive screws clockwise until finger tight. It is recommended that the NIM bin power switch be *off* whenever the module is installed or removed.

The Model 814FP can be operated where the ambient air temperature is between 0 °C and +50 °C (+120 °F maximum). Perforations in the top and bottom sides permit cooling air to circulate through the module. When relay rack mounted along with other heat generating equipment, adequate clearance should be provided to allow for sufficient air flow through both the perforated top and bottom covers of the NIM bin.

Setting the Amplitude

The Pulse Height potentiometer controls the amplitude of the output pulse, with a range of 0 to ± 10 volts open circuit (0 to ± 5 volts, terminated into 50 ohms).

Normalizing the Output

The Norm control allows a 2.5:1 variation of the output amplitude for normalization of the Pulse Height dial, enabling the user to calibrate the Pulse Height dial directly in terms of equivalent energy.

CAL

Setting the Norm control fully clockwise to the CAL position provides a calibrated 0 to ± 10 volt output range.

The Rate Control

The Rate control adjusts the frequency of the Output signal.

Rate Multiplier and Decay Selector

In the Tail Pulse mode, the Decay switch selects one of three decay constants: 1 ms, 50 μ s or 100 μ s.

This switch also selects the multiplier for the RATE control: X10, X100 or X200. Square waves may be selected on any range.

Selecting the Output Mode

To select the output mode, set this switch to either the Tail Pulse position or the Square Wave position.

Attenuating the Output

The Attenuator switches reduce the full scale pulse height by factors of 2, 5, or 10, or any combination of these values.

A. Specifications

Input

DISABLE – Accepts a dc control signal which enables or disables the pulser output signal. Internally selectable as active HI (>2 V to disable; <1.5 V to enable) or active LO (<1.5 V to disable; >2 V to enable). The DISABLE signal is synchronized to the internal pulse generator to terminate the current pulse at the correct time to prevent erroneous outputs; rear panel BNC.

Outputs

OUT – Provides attenuated positive or negative tail pulses or square waves; pulse height 0 to ± 10 V open circuit (0 to ± 5 V when terminated into $50\ \Omega$); rise time <30 ns; fall time constants are independent of output terminations. Attenuation factors of up to 1000 may be selected; $Z_{\text{out}} = 50\ \Omega$; front panel BNC.

SYNC – Provides positive- and negative-going pulses for oscilloscope triggering. Positive oscilloscope triggering syncs on the leading edge of the output waveform, while negative oscilloscope triggering syncs on the trailing edge of the output waveform. Sync pulses are approximately ± 3.5 V, $0.1\ \mu\text{s}$ wide; $Z_{\text{out}} = 50\ \Omega$; front panel BNC.

Controls

PULSE HEIGHT – Front panel ten-turn potentiometer controls output pulse amplitude from 0 to ± 10 V, open circuit (0 to ± 5 V when terminated into $50\ \Omega$.)

NORM/CAL – Front panel multi-turn potentiometer allows a $>2:1$ variation of the output amplitude for normalization of the PULSE HEIGHT dial, enabling the user to calibrate the PULSE HEIGHT dial directly in units of energy. Setting the NORM control fully clockwise to the CAL position provides a calibrated 0 to ± 10 V output range.

RATE – Front panel ten-turn potentiometer and dial provides control of output frequency with a 100:1 range.

DECAY – Front panel three-position toggle switch selects one of three decay constants in Tail Pulse mode and multiplier for the RATE control. Maximum frequency is 2 kHz for the $50\ \mu\text{s}$ decay constant, 1 kHz for the $100\ \mu\text{s}$ decay constant, and 100 Hz for the 1 ms decay constant. The Square Wave output may be selected on any range.

POLARITY – Front panel two-position toggle switch selects POSitive or NEGative output pulse polarity.

Tail Pulse/OFF/Square Wave – Front panel three-position toggle switch selects the pulser's operating mode: OFF disables the output (overrides the rear-panel DISABLE input) and sets the output to 0 V; the Tail Pulse position outputs a tail pulse; the Square Wave position outputs a square wave.

ATTENUATOR – Four front panel two-position toggle switches select attenuation factors of 2, 5, 10 and 10. Total attenuation is the product of the selected attenuators.

DISABLE – Internal jumper selects DISABLE HI (>2 V) or DISABLE LO (<1.5 V) mode for rear panel DISABLE input.

Indicators

ON – Front panel LED illuminates when the Tail Pulse/OFF/Square Wave switch is in either the Tail Pulse or Square Wave position and the pulser is not disabled through the rear panel DISABLE input.

Performance

TEMPERATURE STABILITY – $\leq \pm 0.01\%/^{\circ}\text{C}$.

SUPPLY VOLTAGE STABILITY – $\leq \pm 0.01\%$ for a $\pm 1\%$ change in the ± 24 volt supply voltages.

NORMALIZE RANGE – $>2:1$.

SWITCHING TRANSIENTS – ≤ 0.1 V peak-to-peak, ≤ 20 ns duration.

INTEGRAL NONLINEARITY – $\leq \pm 0.25\%$ of full scale.

DUTY CYCLE – 50% with square wave output selected.

RISE TIME – <30 ns.

FALL TIME – Tail Pulse output: 50 μs , 100 μs or 1 ms, ($\pm 10\%$) selected by front panel switch and independent of output termination; Square Wave output: <30 ns.

Power Requirements

PULSE REPETITION RATE – Range depends on the selected DECAY time: 50 μ s: 20 Hz to 2 kHz; 100 μ s: 10 Hz to 1 kHz; 1 μ s: 1 Hz to 100 Hz; the Square Wave output can be chosen at any range.

Power Requirements

+24 V – 130 mA	+12 V – 60 mA
–24 V – 130 mA	–12 V – 80 mA

Physical

SIZE – Standard single-width NIM module 3.43 x 22.13 cm (1.35 x 8.71 in.) per DOE/ER-0457T.

NET WEIGHT – 1.36 kg (3.0 lb).

SHIPPING WEIGHT – 2.27 kg (5.0 lb).

Environmental

OPERATING TEMPERATURE RANGE – 0 to 50 °C.

OPERATING HUMIDITY RANGE – 0-80% relative, non-condensing.

Tested to the environmental conditions specified by EN 61010, Installation Category I, Pollution Degree 2.

B. Installation Considerations

This unit complies with all applicable European Union requirements.

Compliance testing was performed with application configurations commonly used for this module; i.e. a CE compliant NIM Bin and Power Supply with additional CE compliant application-specific NIM were racked in a floor cabinet to support the module under test.

During the design and assembly of the module, reasonable precautions were taken by the manufacturer to minimize the effects of RFI and EMC on the system. However, care should be taken to maintain full compliance. These considerations include:

- A rack or tabletop enclosure fully closed on all sides with rear door access
- Single point external cable access
- Blank panels to cover open front panel Bin area
- Compliant grounding and safety precautions for any internal power distribution
- The use of CE compliant accessories such as fans, UPS, etc.

Any repairs or maintenance should be performed by a qualified Canberra service representative. Failure to use exact replacement components, or failure to reassemble the unit as delivered, may affect the unit's compliance with the specified EU requirements.

Warranty

Canberra (we, us, our) warrants to the customer (you, your) that for a period of ninety (90) days from the date of shipment, software provided by us in connection with equipment manufactured by us shall operate in accordance with applicable specifications when used with equipment manufactured by us and that the media on which the software is provided shall be free from defects. We also warrant that (A) equipment manufactured by us shall be free from defects in materials and workmanship for a period of one (1) year from the date of shipment of such equipment, and (B) services performed by us in connection with such equipment, such as site supervision and installation services relating to the equipment, shall be free from defects for a period of one (1) year from the date of performance of such services.

If defects in materials or workmanship are discovered within the applicable warranty period as set forth above, we shall, at our option and cost, (A) in the case of defective software or equipment, either repair or replace the software or equipment, or (B) in the case of defective services, reperform such services.

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Our warranty does not cover damage to equipment which has been altered or modified without our written permission or damage which has been caused by abuse, misuse, accident, neglect or unusual physical or electrical stress, as determined by our Service Personnel.

We are under no obligation to provide warranty service if adjustment or repair is required because of damage caused by other than ordinary use or if the equipment is serviced or repaired, or if an attempt is made to service or repair the equipment, by other than our Service Personnel without our prior approval.

Our warranty does not cover detector damage due to neutrons or heavy charged particles. Failure of beryllium, carbon composite, or polymer windows, or of windowless detectors caused by physical or chemical damage from the environment is not covered by warranty.

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